AD-A143 489 NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS KENSINGTON DAM (CT-00..(U) CORPS OF ENGINEERS WALTHAM MA NEW ENGLAND DIV FEB 79 1/1

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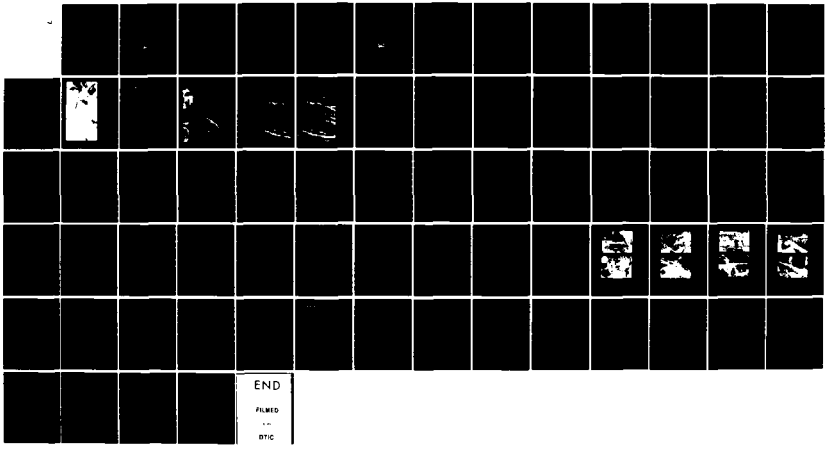

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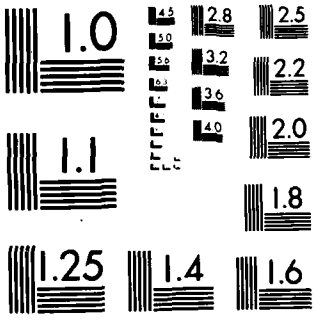

LOWER CONNECTICUT RIVER BASIN
BERLIN , CONNECTICUT

KENSINGTON DAM
CT 00250

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

FEBRUARY 1979

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE	READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER: CT 00250	2. GOVT ACCESSION NO.: AD-A143 489
	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle): Kensington Dam NATIONAL PROGRAM FOR INSPECTION OF NON-FEDERAL DAMS	5. TYPE OF REPORT & PERIOD COVERED: INSPECTION REPORT
	6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s): U.S. ARMY CORPS OF ENGINEERS NEW ENGLAND DIVISION	8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS: DEPT. OF THE ARMY, CORPS OF ENGINEERS NEW ENGLAND DIVISION, NEDED 424 TRAPELO ROAD, WALTHAM, MA. 02254	12. REPORT DATE: February 1979 13. NUMBER OF PAGES: 45
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16. DISTRIBUTION STATEMENT (of this Report)

APPROVAL FOR PUBLIC RELEASE: DISTRIBUTION UNLIMITED

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Lower Conn. River Basin
Berlin, Conn.

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is a 205 foot long concrete gravity structure keyed into rock at both abutments. The top of the dam is typically 5.5 feet wide and approx. 25 feet above the bed of the Mattabesset River. Based upon the visual inspection at the site and past performance history, the dam appears to be in fair condition. Based upon the size (small) and hazard classification (high) of the dam in accordance with Corps of Engineers Guidelines, the test flood in-flow will be equivalent to one-half the PMF.

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DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
424 TRAPELO ROAD
WALTHAM, MASSACHUSETTS 02154

REPLY TO
ATTENTION OF:
NEDED-E

JUN 16 1979

Honorable Ella T. Grasso
Governor of the State of Connecticut
State Capitol
Hartford, Connecticut 06115

Dear Governor Grasso:

I am forwarding for your use a copy of the Kensington Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. The report is based upon a visual inspection, a review of past performance, and a preliminary hydrological analysis. A brief assessment which emphasizes the inadequacy of the project spillway under test flood conditions is included at the beginning of the report.

The preliminary hydrologic analysis has indicated that the spillway capacity for the Kensington Dam would likely be exceeded by floods greater than 18 percent of half the Probable Maximum Flood (1/2 PMF), the test flood for spillway adequacy. Screening criteria for initial review of spillway adequacy specifies that this class of dam, having insufficient spillway capacity to discharge the 1/2 PMF, should be adjudged as having a seriously inadequate spillway and the dam assessed as unsafe, non-emergency, until more detailed studies prove otherwise or corrective measures are completed.

The classification of "unsafe" applied to a dam because of a seriously inadequate spillway is not meant to indicate the same degree of emergency as would be associated with "unsafe" classification applied for a structural deficiency. It does mean, however, that based on an initial screening and preliminary computations there appears to be a serious deficiency in spillway capacity. This could render the dam unsafe in the event of a severe storm which would likely cause overtopping and possible failure of the dam, significantly increasing the hazard potential for loss of life downstream from the dam.

NEDED-E
Honorable Ella T. Grasso

It is recommended that within twelve months from the date of this report the owner of the dam engage the services of a professional or consulting engineer to determine by more sophisticated methods and procedures the magnitude of the spillway deficiency. Based on this determination, appropriate remedial mitigating measures should be designed and completed within 24 months of this date of notification. In the interim a detailed emergency operation plan and warning system should be promptly developed. During periods of unusually heavy preciptiation, round-the-clock surveillance should be provided.

I have approved the report and support the findings and recommendations described in Section 7, with qualifications as noted above. I request that you keep me informed of the actions taken to implement these recommendations since this follow-up is an important part of the non-Federal Dam Inspection Program.

A copy of this report has been forwarded to the Department of Environmental Protection, the cooperating agency for the State of Connecticut. This report has also been furnished to the owner of the project, the town of Berlin, Berlin Town Hall, 240 Kensington Road, Berlin, Connecticut 06037, ATTN: Mr. Morgan Seeley, Town Engineer.

Copies of this report will be made available to the public, upon request to this office, under the Freedom of Information Act, thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Protection for the cooperation extended in carrying out this program.

Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

LOWER CONNECTICUT RIVER BASIN
BERLIN , CONNECTICUT

KENSINGTON DAM
CT 00250

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

FEBRUARY 1979

BRIEF ASSESSMENT

PHASE I INSPECTION REPORT

NATIONAL PROGRAM OF INSPECTION OF DAMS

Name of Dam:	KENSINGTON DAM
Inventory Number:	CT 00250
State Located:	CONNECTICUT
County Located:	HARTFORD
Town Located:	BERLIN
Stream:	MATTABASSET RIVER
Owner:	TOWN OF BERLIN
Date of Inspection:	DECEMBER 6, 1978
Inspection Team:	CALVIN GOLDSMITH
	GONZALO CASTRO
	THOMAS KELLER
	MORGAN SEELEY
	DONALD PRUE

The dam is a 205 foot long concrete gravity structure keyed into rock at both abutments. The top of the dam is typically 5.5 feet wide and approximately 25 feet above the bed of the Mattabesset River. The upstream face of the dam by visual inspection is vertical, while the downstream face is battered on an inclination of approximately 2 horizontal to 1 vertical based upon field measurements. The spillway is a concrete, broad crested compound weir of trapezoidal cross-section with a shallow bucket dissipator apron. The spillway crest is 3.0 feet below the top of the dam. There are two low level gates on the upstream face of the dam. One gate feeds the 42 inch cast iron low level outlet, and is operable. The other gate feeds a pipeline which was used to provide water to the downstream railroad line. This gate is inoperable and the present existence and condition of the pipeline is uncertain. There are three residential structures and a storage building located immediately downstream of the dam.

Based upon the visual inspection at the site and past performance history, the dam appears to be in fair condition. No evidence of instability in the dam was observed. Downstream of the dam approximately 70 feet, the left channel wall is collapsed and at this point is in poor condition. There are some other areas requiring attention as well, in the form of minor maintenance or monitoring.

Based upon the size (small) and hazard classification (high) of the dam in accordance with Corps of Engineers Guidelines, the test flood in-flow will be equivalent to one-half the Probable Maximum Flood (PMF). Peak inflow to the lake is 8900 cfs; peak outflow (Test Flood) is 8800 cfs with the dam overtopped 4.2 feet. The peak failure outflow from the dam breaching would be 14,200 cfs. Based upon our hydraulics computations, the spillway capacity is 1560 cubic feet per second (cfs), which is equivalent to 18% of the Test Flood. A breach of the dam would develop an 11 foot wave downstream of the dam, with potential for causing loss of life and extensive damage to property.

It is recommended that further studies be undertaken to perform a more refined hydraulic/hydrologic study to determine the best way to increase the capability of the spillway to pass a greater percentage of the Test Flood.

It is further recommended that an operation and maintenance plan be instituted. The downstream face of the dam should be observed and any existing seeps be monitored on a monthly basis and complete records, including photographs of the seeps, should be kept. Additional recommendations and remedial measures are described in Section 7.

The above recommendations and remedial measures which are further discussed in Section 7, should be instituted within 1 year of the owner's receipt of this Phase I Inspection Report.

Peter M. Heynen, P.E.
Project Manager
Cahn Engineers, Inc.

Edgar B. Vinal Jr., P.E.
Senior Vice President
Cahn Engineers, Inc.

This Phase I Inspection Report on Kensington Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Charles G. Tiersch

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens Jr

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspection. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions will be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions there of. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as neccessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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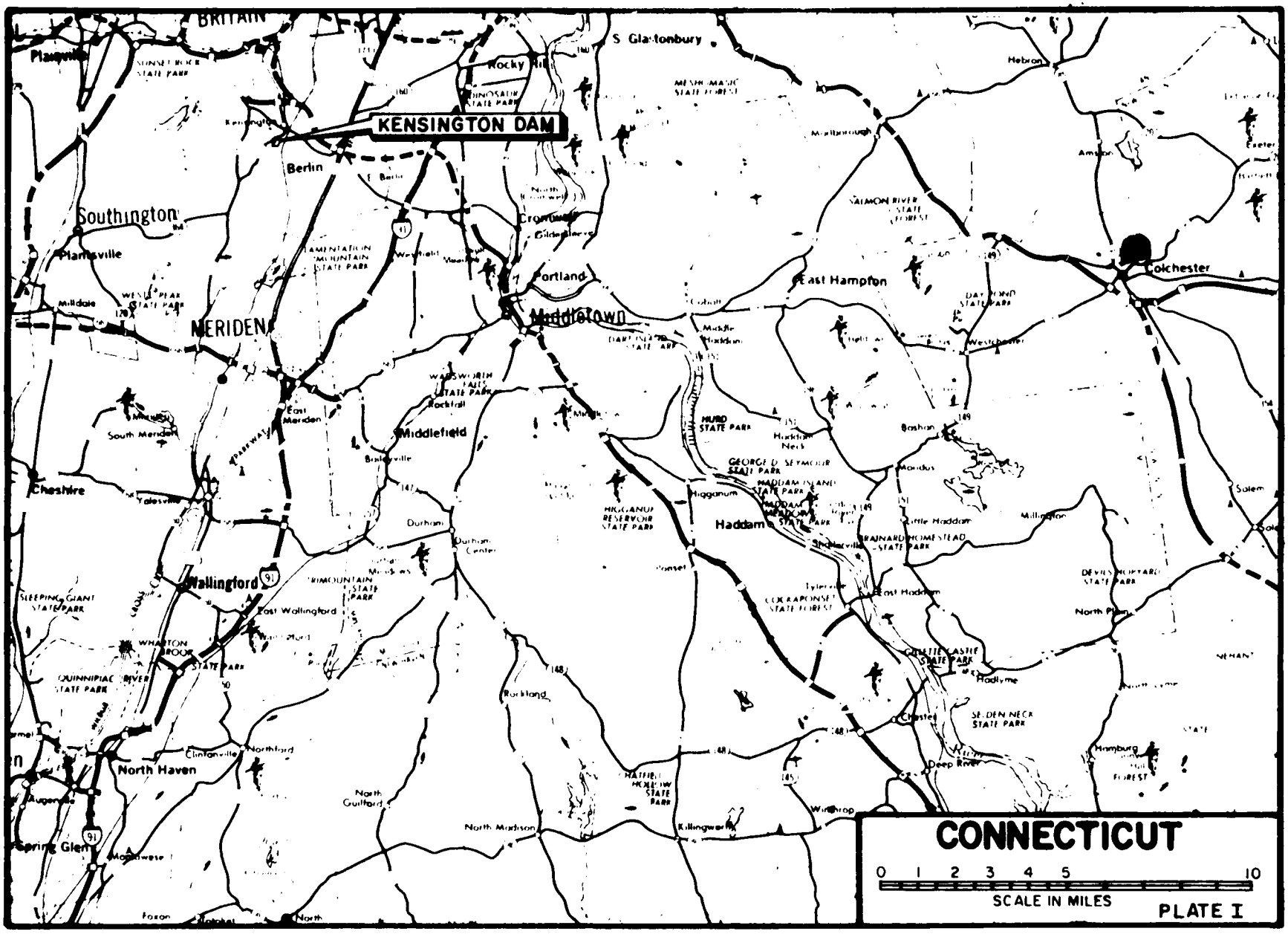
APPENDIX

OVERVIEW PHOTO

US ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS LAMB ENGINEERS INC WALLINGFORD, CONN ARCHITECT-ENGINEER	NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS	KENSINGTON DAM MATTABESSET RIVER	BERLIN CONNECTICUT	DATE FEB 1979 CE # 595 PAGE ix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BRITAIN
Plainville
Rocky Hill
S Glastonbury
Hebron
Berlin
Southington
Plantsville
Cromwell
Portland
Middletown
East Hampton
Colchester
MERIDEN
East Meriden
Middlefield
Cheshire
Durham
Wallingford
East Wallingford
North Haven
Clinton
Northford
North Guilford
North Madison
Killingworth
Higganum
Haddam
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Salem
Portland
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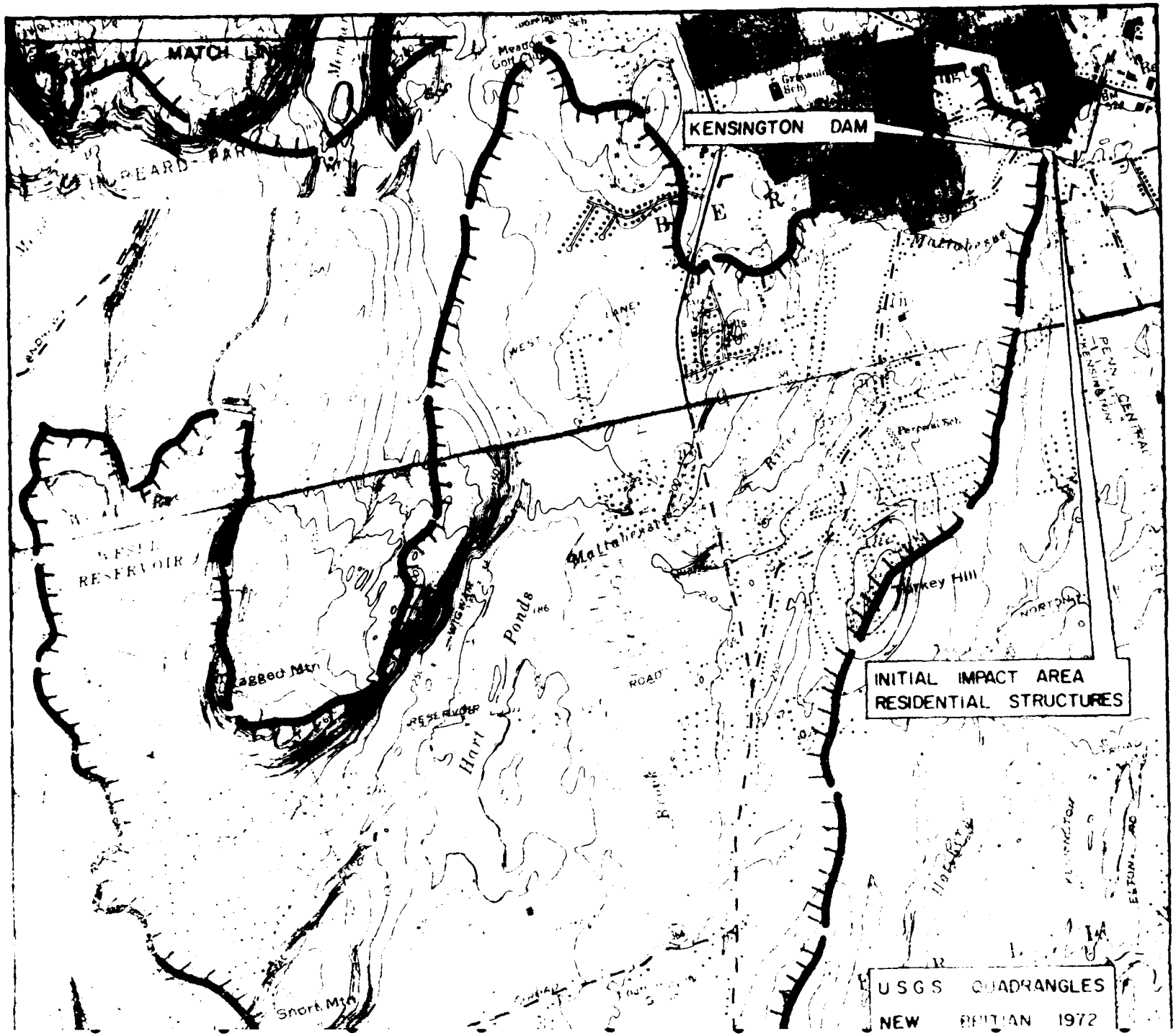
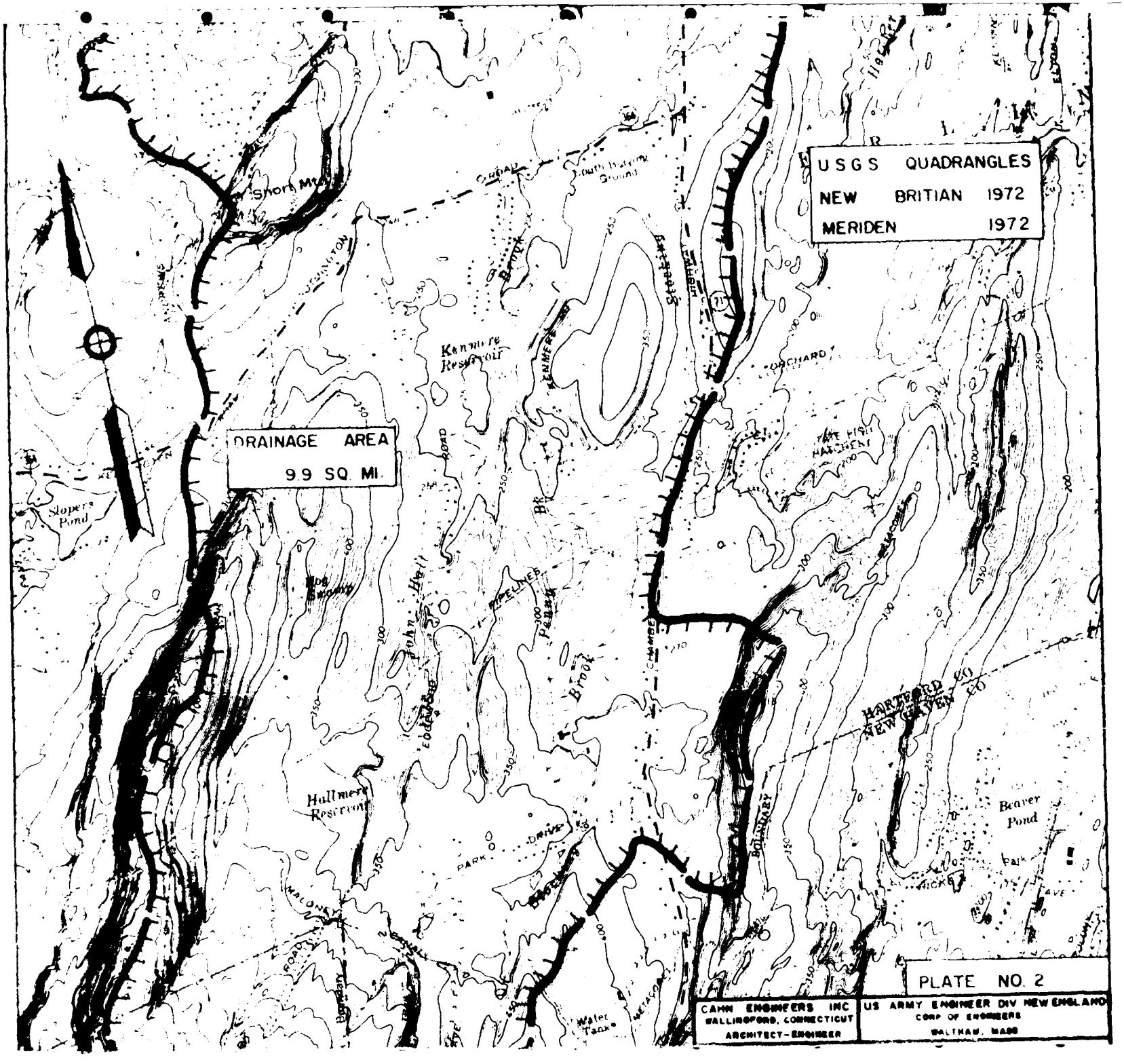
SCALE IN MILES
PLATE I


KENSINGTON DAM
INITIAL IMPACT AREA
RESIDENTIAL STRUCTURES
USGS QUADRANGLES
NEW BRITAIN 1972


USGS QUADRANGLES
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MERIDEN 1972
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Kenmore Reservoir
Hallmere Reservoir
Slopers Pond
Beaver Pond
Short Mtn.
PLATE NO. 2
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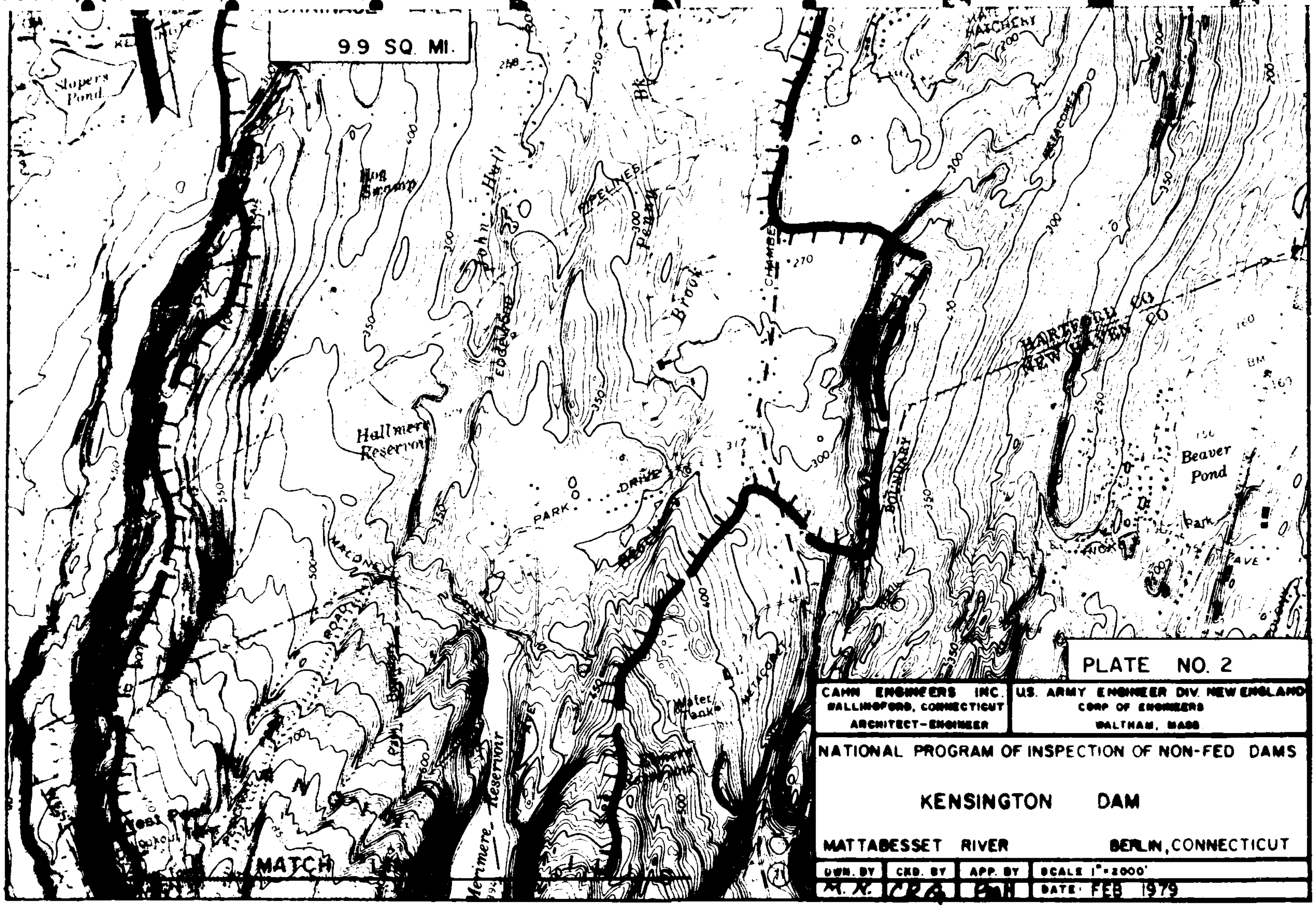
ARCHITECT-ENGINEER
US ARMY ENGINEER DIV NEW ENGLAND
CORP OF ENGINEERS
WALTHAM, MASS


9.9 SQ. MI.
Slopers Pond
Hog Swamp
John Hall
PIPELINES
Penny
Bk
Brook
CHAMBE
270
Hallmere Reservoir
PARK DRIVE
317
MALONEY
ROAD
Hallmere Reservoir
Water Tank
BOUNDARY
HARTFORD CO
NEW HAVEN CO
Beaver Pond
Park
AVE
MATCH
PLATE NO. 2
CAHN ENGINEERS INC.
WALLINGFORD, CONNECTICUT
ARCHITECT-ENGINEER
U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORP OF ENGINEERS
WALTHAM, MASS
NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS
KENSINGTON DAM
MATTABESSET RIVER
BERLIN, CONNECTICUT
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SCALE 1"=2000'
DATE FEB 1979

KENSINGTON DAM

SECTION I

PROJECT INFORMATION

1.1 General

a. Authority

Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region. Cahn Engineers, Inc. has been retained by the New England Divsion to inspect and report on selected dams in the State of Connecticut. Authorization and notice to proceed were issued to Cahn Engineers, Inc. under a letter of November 28, 1978 from Max B. Scheider, Colonel, Corps of Engineers. Contract No DACW33-79-C-0014 has been assigned by the Corps of Engineers for this work.

b. Purpose of Inspection Program

The purposes of the program are to:

(1) Perform technical inspection and evaluation of non-federal dams to identify conditions requiring correction in a timely manner by non-federal interests.

(2) Encourage and prepare the States to quickly initiate effective dam inspection programs for non-federal dams.

(3) To update, verify and complete the National Inventory of Dams.

c. Scope of Inspection Program

The scope of this Phase I inspection report includes:

(1) Gathering, reviewing and presenting all available data that can be obtained from the owners, previous owners, the state and other associated parties.

(2) A field inspection of the facility detailing the visual condition of the dam, embankments and appurtenant structures.

(3) Computations concerning the hydraulics and hydrology of the facility and its relationship to the calculated flood through the existing spillway.

(4) An assessment of the condition of the facility and corrective measures required.

It should be noted that this report does not pass judgment on the safety or stability of the dam other than on a visual basis. The inspection is to identify those features on the dam which need corrective action and/or further study.

1.2 Description of Project

a. Description of Dam and Appurtenances

The 205 foot long dam is a concrete gravity structure keyed into rock at each abutment and probably for the length of the dam. The top of the dam is typically 5.5 feet wide and approximately 25 feet above the bed of the Mattabesset River. The upstream face of the dam appears to be vertical while the downstream face is battered to an inclination of approximately 2 horizontal to 1 vertical, based upon field measurements. The spillway is a broad crested concrete weir of trapezoidal cross section with a shallow bucket dissipator apron. The crest of the spillway is approximately 3 feet below the top of the dam. The low level outlet is a 42" cast iron pipe discharging to the left of the spillway abutment at approximately elevation 46.7.

There are two gates on the inlet structure. The right gate feeds the low level outlet, and is operable by means of a hand-cranked pedestal lift. The left gate feeds a buried pipeline which was built to carry water approximately 200 yards downstream to a railroad. The hand wheel lift for this gate is cracked at its base and is presently inoperable. It is not known whether the pipeline still exists or what its condition may be.

b. Location - The dam is located on the Mattabasset River in a rural area of the Town of Berlin, County of Hartford, State of Connecticut. The dam is shown on the New Britain USGS Quadrangle Map as having coordinates latitude N $41^{0}37.9'$ and longitude W $72^{0}46.2'$. Three houses and a storage building are located adjacent to the river less than 200 yards downstream from the dam.

c. Size Classification - SMALL - The dam is approximately 25 feet high and impounds approximately 198 acre-feet of water with the lake level at the top of the dam, elevation 70. According to the Recommended Guidelines, a dam with storage of less than 1000 acre-feet and a height of less than 40 feet is classified as small.

d. Hazard Classification - HIGH - Three residential structures and a storage building are located near the river immediately downstream of the dam. Should the dam be breached or overtopped, there is potential for loss of life and extensive property damage at the downstream developments.

e. Ownership

Town of Berlin
Berlin Town Hall
240 Kensington Road
Berlin, Connecticut
Mr. Morgan Seeley, Town Engineer
(203) 828-3501
Mr. Donald Prue, Director of Highways
(203) 828-0426

f. Operator - None

g. Purpose of Dam - The dam was originally constructed to provide a dependable water supply for the New York, New Haven, Hartford Railroad line immediately downstream. It's use is recreational at present.

h. Design and Construction History - The following information is believed to be accurate based on the plans and correspondence available. The dam was constructed in 1901 by the New York, New Haven, Hartford Railroad to provide a dependable water supply for its steam locomotives. According to the Town Engineer, the only alterations performed on the dam since, were performed sometime between 1961 and 1964 when a developer acquired the dam and attempted to remove it. The left side of the sillway was jackhammered down 3 feet and the rest of the spillway cap and the abutments were partially jackhammered before the attempted removal was aborted.

i. Normal Operational Procedures - The low level outlet gate is usually opened twice a year during times of high water or during large storms. There are no trash racks, so the gate is raised a maximum of one foot and left open as little as possible to minimize the chances of blockage due to debris.

1.3 Pertinent Data

a. Drainage Area - 9.9 square miles. Rolling to mountainous terrain. Development consists of residential subdivisions in the northern portion of the drainage area near where the dam is. The southern portion of the drainage area is more mountainous terrain and largely undeveloped.

b. Discharge at Dam Site - There is one operable low level outlet and the spillway discharging from the pond.

Outlet works (conduit):	42 inch @ el. 46.7
Maximum known flood at Damsite:	N/A
Ungated spillway capacity @ top of dam:	1560 cfs @ el. 70
Ungated spillway capacity at test flood el.:	1560 cfs
Gated spillway capacity at normal pool el.:	N/A
Total spillway capacity at test flood el.:	1560 cfs
Total project discharge @ test flood el.:	N/A

c. Elevations - (Ft. above MSL, USGS Datum. Elevations are relative to the water surface elevation shown on the New Britain USGS Quadrangle Map which was taken to be the spillway crest elevation.)

Streambed at centerline of dam:	El. 45
Maximum tailwater:	N/A
Upstream portal invert diversion tunnel:	N/A
Recreation pool:	El. 67
Full flood control pool:	N/A
Spillway crest:	El. 67
Design surcharge (Original Design):	N/A
Top of Dam:	El. 70
Test flood design surcharge:	El. 74.2

d. Reservoir

Length of maximum pool:	1450+ ft.
Length of recreation pool:	1450 ft.
Length of flood control pool:	1450+ ft.

e. Storage - (Given a height of the top of dam over the spillway crest of 3 feet and a surface area of 11.2 acres, the following storage figures, from the Corps Inventory Sheet, become questionable. For the hydraulic computations, the figure for maximum storage at the top of dam elevation was assumed valid.)

Recreation pool (El. 67):	180 ac.-ft.
Flood control pool:	N/A
Spillway crest pool (El. 67):	180 ac.-ft.
Top of dam (El. 70):	198 ac.-ft.
Test flood pool:	N/A

f. Reservoir Surface

Top of dam:	11.2+ acres
Test flood pool:	N/A
Flood control pool:	N/A
Recreation pool:	11.2 acres
Spillway crest:	11.2 acres

g. Dam

Type:	Concrete gravity section
Length:	205 ft.
Height:	25± ft.
Top Width	5.5 ft.
Side Slopes:	Vertical (Upstream) 2H to 1V (Downstream)
Zoning:	N/A
Impervious Core:	N/A

Cutoff:	Rock ledge (probably)
Grout curtain:	N/A
Other:	N/A

h. Diversion and Regulating Tunnel - N/A

i. Spillway - (Dimensions based on field measurements)

Type:	Broad crested concrete weir
Length of weir:	74 ft.
Length of weir with notch (left to right):	3' @ el. 67 9.9' @ el. 63.6 6.2' @ el. 65.1 55' @ el. 67
Crest elevation:	67
Gates:	None
U/S Channel:	N/A
D/S Channel:	gravel streambed
General:	Notched out at left end of spillway

j. Regulating Outlets

Invert:	N/A
Size:	42 inch diameter
Description:	Cast iron pipe
Control Mechanism:	Hand-crank pedestal lift
Other:	Left gate inoperable, Originally to buried pipeline supplying downstream Railroad line.

SECTION 2

ENGINEERING DATA

2.1 Design

a. Available Data

The available data consists of correspondence between the State and the previous owner, and a state dam inventory sheet. There were no plans, calculations, or design reports available.

b. Design Features

The available correspondence indicates the design features stated previously in Section 1.

c. Design Data

There were no engineering values, assumptions, test results, or calculations available for the design or construction of the dam.

2.2 Construction

a. Available Data

No information was available.

b. Construction Considerations

No information was available.

2.3 Operations

To our knowledge, lake level readings are not taken. Based on hearsay, the owner estimated the water level did not rise higher than approximately 1 foot below the top of the dam during the August and October, 1955 floods, which was prior to when the attempted removal of the dam resulted in part of the spillway being cut away. No formal operations records exist.

2.4 Evaluation

a. Availability

Existing data was provided by the State of Connecticut Department of Water and Related Resources. The owner made the dam available for visual inspection.

b. Adequacy

Due to the absence of plans and detailed engineering data available, it was not possible to perform an in-depth assessment of the dam. Therefore, the final assessment of this investigation must be based primarily on visual inspection, the performance history of the dam based on hearsay evidence, hydraulic computations of spillway capacity and approximate hydrologic judgement.

c. Validity

A comparison of the limited amount of data available and the visual observations reveals no observable significant discrepancies.

SECTION 3

VISUAL INSPECTION

3.1 Findings

a. General

The general condition of the dam is fair. Inspection revealed severe cracks in the upstream and downstream faces of the dam, and deterioration of the spillway.

b. Dam

The reservoir level was at approximately elevation 64.5 at the time of our field inspection.

Crest

The crest is typically 5.5' wide and approximately 131 feet long. The crest appears to be in good condition with some cracking and surface concrete deterioration.

Downstream Face

The downstream face of the dam to the right of the spillway has two major horizontal cracks as shown in Photos 5 and 6. Spalling in the cracks has revealed the interior concrete of the dam, which appears to be of a lesser quality than the exterior concrete. There was seepage through the cracks, which showed no evidence of soil transportation.

Cracks in the left downstream face have minor seepage, also. There is a minor seep emanating from the downstream contact between the dam and the rock abutment on the left side. Again, no soil transportation was evident. Erosion was observed adjacent to the dam on the left abutment caused by runoff from the roadway just above the abutment. The left downstream face erosion and seepage is shown in Photos 3 and 4, respectively.

There are several trees growing in close proximity to the downstream face of the dam.

Upstream Face

The upstream face of the dam also exhibits cracks, the worst area being near the right and left abutments. Near the right abutment, a horizontal crack up to 0.4 feet in depth exposed the interior concrete of the dam. At the time of our field investigation, this crack was above the water line. Any cracking below the water line was not observable. Refer to Photos 7 and 8 for views of the upstream face from the right abutment. Cracking of the upstream face of the dam was also observed adjacent to the left abutment.

Spillway

The spillway (Photo 1) is in poor condition having been partially removed by jackhammering for a distance of approximately 16 feet to a maximum depth of 3 feet. The crest of the spillway for the remainder of its length is intact although an attempt was made to remove it by jackhammering downsteam of the crest. The attempt was abandoned while this portion of the spillway crest was still intact.

c. Appurtenant Structures

Gate Structure

The inlet gate structure is located immediately to the left of the spillway on the upstream side of the dam. The hand-crank pedestal lift which operates the right gate is operable and feeds the low level outlet, shown in Photo 2. The hand wheel lift to the left gate is cracked and presently inoperable. Photo 1 shows the cast iron gate operating mechanisms.

Retaining Wall

A concrete retaining wall extends from the left abutment of the dam westerly along the shoreline of the lake and adjacent to the roadway above it. The concrete wall is cracked and spalled near the top as shown partially in Photo 1, as well as near the water line adjacent to the dam. The cracking at the water line is in both the horizontal and vertical direction, and appears to be up to 0.5± feet deep. It is possible that contact seepage emerging on the downstream face of the dam could be due, at least in part, to infiltration through the observed cracking, and through any unseen cracking below the water level.

d. Reservoir Area - The area surrounding the reservoir is largely a wooded area with cottages adjacent to the reservoir for a portion of the shoreline.

e. Downstream Channel - The downstream river has a gravel bottom and an island with a small tree approximately 35 feet downstream of the dam in the center of the channel. The right channel embankment has been eroded by spillway flows, while the left channel embankment is protected by a stone and mortar retaining wall. This retaining wall has deteriorated, however, beginning approximately 70 feet downstream from the spillway. Numerous trees line the channel further downstream as can be seen in the overview photo.

3.2 Evaluation

Based upon the visual inspection, it was possible to assess the dam as being generally in fair condition. The following features which could influence the future condition and/or stability of the dam were identified.

1. The upstream and downstream cracking of the dam and subsequent spalling of the concrete due to the resulting seepage will continue to worsen with time. In times of high water where the most serious upstream cracking would be submerged, seepage through the dam could increase and eventually become a serious problem.

2. Erosion of the left abutment due to runoff from the road should not go unchecked.

3. Spalling of the concrete retaining wall upstream of the dam will continue to increase and could eventually compromise the stability of the wall, leading to a possible blockage of the low level outlets. Cracks in the wall adjacent to the left dam abutment could be contributing to seepage emerging on the downstream face of the dam.

4. There are trees growing in close proximity to the downstream toe of the dam.

SECTION 4

OPERATIONAL PROCEDURES

4.1 Regulating Procedures

Of the two existing hand operated gates, only the right gate feeding the 42 inch cast iron low level outlet is operable. (See Photo 1.) The gate is opened a maximum of one foot during major storms or when the water level rises to the original elevation of the spillway. Usually the gate is opened only two or three times a year, as the lack of trash racks causes concern that a log or other debris could block up the gate and prevent it from being closed.

4.2 Maintenance of Dam

There are no known maintenance procedures for the dam.

4.3 Maintenance of Operating Facilities

The hand crank lift for the right gate is greased with a graphite grease when the gate is opened, usually two or three times a year.

4.4 Description of Any Formal Warning System in Effect

There is no formal warning system in effect. During major storms the dam is checked periodically by the owner. Should there be problems, the Town of Berlin Police Department would be contacted.

4.5 Evaluation

The operational procedures for the dam are adequate, however the very limited maintenance procedures should be improved. A formal program of operation and maintenance procedures should be implemented, including documentation to provide complete records for future reference. Also, a formal warning system should be developed and implemented within the time frame indicated in Section 7.1.c. Remedial operation and maintenance recommendations are presented in Section 7.

SECTION 5

HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. General - The attempted removal of the dam in the early 1960's resulted in a notch being cut in the left side of the spillway, which dropped the lake's normal pool over 3 feet allowing for increased storage. The spillway capacity was also boosted, although not by a significant amount.

b. Design Data

No computations could be found for the original dam construction.

c. Experience Data

No information on serious problem situations arising at the dam was found, and it does not appear the dam has been overtopped. The maximum height of water over the spillway was 2 feet during the August and October, 1955 floods, based upon hearsay evidence, only.

d. Visual Observations

During times of low inflow to the lake, the pool elevation is lower than the original spillway crest elevation due to the lowered left portion of the spillway. There appears to be a good deal of siltation in the downstream channel near the low level outlet. The owner recalled seeing mud flats upstream of the dam during times of very low water levels.

e. Test Flood Analysis - The test flood for this high hazard, small size dam is equivalent to one-half of the Probable Maximum Flood (PMF).

Based upon "Preliminary Guidance for Estimating Maximum Probable Discharges", dated March, 1978, peak inflow to the reservoir is 8900 cfs (Appendix D-8); peak outflow (Test Flood) is 8800 cfs with the dam overtopped 4.2 feet (Appendix D-13). Based upon our hydraulics computations, the spillway capacity is 1560 cfs with the water level at the top of the dam, which is equivalent to approximately 18 percent of Test Flood.

Utilizing the April, 1978 "Rule of Thumb Guidance for Estimating Downstream Dm Failure Hydrographs", the peak failure outflow from the dam breaching would be 14,200 cubic feet per second which would result in an 11 foot wave immediately downstream of the dam at the residential structures in the initial impact area.

SECTION 6

STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

Cracking of the concrete surface of the crest of the dam on both sides of the spillway and on both upstream and downstream faces of the dam was observed. Seepage was observed eminating from cracks in the downstream face on both sides of the spillway and along the contact with natural ground at the left abutment. The spillway and spillway abutments were damaged as a result of the attempted removal during the early 1960's (Photo 1). Based on visual observations, it does not appear that the structural deterioration observed will compromise the immediate structural integrity of the dam.

b. Design and Construction Data

There was no design or construction data available, therefore it was not possible to perform an in-depth assessment of the structural stability of the dam.

c. Operating Records

There are no operating records available.

d. Post Construction Changes

The only post construction change known to have taken place was the private developer's aborted attempt to remove the dam in the early 1960's, which appears to have had little effect on the structural stability of the dam.

e. Seismic Stability

The dam is in Seismic Zone 1 and according to the Recommended Guidelines, need not be evaluated for seismic stability.

SECTION 7

ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition

Based upon the visual inspection of the site and past performance, the dam appears to be in fair condition. No evidence of structural instability of the dam was observed. The upstream concrete retaining wall is spalled in places, however, it did not appear to be unstable. The left downstream channel wall where it decreases in size significantly, is partially collapsed beginning approximately 70 feet downstream of the dam; however, at the present time, the remaining major portion of the wall appears stable. There are some areas of the dam requiring attention, particularly the cracks and seepage in the downstream face of the dam. Continued erosion coupled with freeze - thaw action of the seepage could cause further cracking and seriously compromise the stability of the dam. Other areas of concern include the inadequate spillway capacity and the minor erosion of the left abutment due to storm runoff.

Based upon "Preliminary Guidance for estimating Maximum Probable Discharges" dated March, 1978, peak inflow to the reservoir is 8900 cubic feet per second; peak outflow (Test Flood) is 8800 cubic feet per second with the dam overtopped approximately 4.2 feet. Based upon our hydraulics computations, the spillway capacity is 1560 cubic feet per second, which is equivalent to approximately 18 percent of the Test Flood.

b. Adequacy of Information

The information available is such that an assessment of the condition and stability of the dam must be based solely on visual inspection, the past performance of the dam, and sound engineering judgement.

c. Urgency

It is recommended that the measures presented in Section 7.2 and 7.3 be implemented within 1 year of the owner's receipt of this report.

d. Need for Additional Information

There is a need for more information as recommended in Section 7.2.

7.2 Recommendations

1. Based upon the rough computations in Appendix D, the dam spillway capacity will be exceeded by the Test Flood. More sophisticated flood routing should be undertaken by hydrologists/hydraulics engineers to refine the Test Flood figures. A study should be undertaken to determine methods to be used to increase the spillway capacity to an acceptable level based upon the refined Test Flood figures.

2. An engineer qualified in dam design and inspection should investigate the cracking of the dam and the left upstream retaining wall, and recommend methods of sealing the upstream cracks in the dam and retaining wall against seepage. The engineer should also develop a system of monitoring the seepage both through the dam and along the contact with the left dam abutment. The seepage should be monitored monthly (complete with photographic records) to ascertain the volume of flow, the degree of silt transport, especially along the contact with the left abutment, and the development of any new seepage. Turbidity of the water, appearance of new seeps, or substantial changes in flow not related to changes in the lake level should be considered as possible indications of an unsafe condition. Should any of these occur, the engineer should investigate the problem to determine any required actions.

3. An engineer qualified in dam design and inspection should be retained to investigate the left gate and the buried pipeline it controls, to determine the actions required to permanently seal the outlet.

7.3 Remedial Measures

a. Operation and Maintenance Procedures

The following measures should be undertaken within the time frame indicated in Section 7.1.C, and continued on a regular basis where applicable.

1. Round-the-clock surveillance should be provided by the owner during periods of unusually heavy precipitation. The owner should develop a formal warning system with local officials for alerting downstream residents in case of an emergency.

2. A formal program of operation and maintenance procedures should be instituted and fully documented to provide accurate records for future reference.

3. A program of inspection by a registered professional engineer qualified in dam inspection should be instituted on an annual basis. The inspections should be of a technical nature and should include the opening of all operable low level outlets.

4. Trees growing adjacent or within close proximity to the toe of the dam should be removed to preclude the possibility of tree roots providing seepage paths through or under the dam.

5. The stone retaining wall of the left side of the downstream channel should be repaired where it has started to fall.

6. The erosion gully for the roadway storm runoff should be repaired and provisions made to control the runoff and divert it away from the dam.

7.4 Alternatives

This study has identified no practical alternatives to the above recommendations and remedial measures.

APPENDIX

SECTION A: VISUAL OBSERVATIONS

VISUAL INSPECTION CHECK LIST
PARTY ORGANIZATION

PROJECT KENSINGTON DAM

DATE: 12/6/78

TIME: 11 AM

WEATHER: SUNNY 40°

W.S. ELEV. 63.5 U.S. _____ DN.S

PARTY:	INITIALS:	DISCIPLINE:
1. CALVIN GOLDSMITH	CG	PROJECT ENGINEER
2. GONZALO CASTRO	GC	GEOTECHNICAL ENGRS. INC.
3. THOMAS KELLER	TK	GEOTECHNICAL ENGRS INC
4. MICHAEL SEELEY	MS	TOWN ENGINEER
5. DON PRUE	DP	DIRECTOR OF HIGHWAYS TOWN OF BERLIN
6.		

	PROJECT FEATURE	INSPECTED BY	REMARKS
1.	CONCRETE DAM	CG, GC, TK (ALL)	
2.	ENTAKE GATE STRUCTURE		
3.	LOW LEVEL OUTLET		
4.	SPILLWAY AND CHANNELS		
5.			
6.			
7.			
8.			
9.			
10.			
11.			
12.			

PERIODIC INSPECTION CHECK LIST

PROJECT KENSINGTON DAM DATE 12/6/78

PROJECT FEATURE CONCRETE DAM BY CG, GC, IK

AREA EVALUATED		CONDITION
DAM EMBANKMENT		
Crest Elevation		EL. 70
Current Pool Elevation		
Maximum Impoundment to Date		NA
Surface Cracks		TOP SPALLED W/ SURFACE CRACKS
Pavement Condition		NA
Movement or Settlement of Crest		NONE OBSERVED
Lateral Movement		NONE OBSERVED
Vertical Alignment		OK
Horizontal Alignment		OK
Condition at Abutment and at Concrete Structures		ABUTMENTS IN ROCK - GOOD CONDITION
Indications of Movement of Structural Items on Slopes		LEFT D/S CHANNEL RETAINING WALL PARTIALLY COLLAPSED
Trespassing on Slopes		SOME ON RIGHT D/S SLOPE
Sloughing or Erosion of Slopes or Abutments		SOME EROSION @ LEFT D/S ABUTMENT FACE
Rock Slope Protection-Riprap Failures		NA
Unusual Movement or Cracking at or Near Toes		NONE OBSERVED
Unusual Embankment or Downstream Seepage		CONTACT SEEP @ LEFT ABUTMENT CRACKS & SEEPAGE IN D/S FACE TO RIGHT OF SPILLWAY
Piping or Boils		NONE OBSERVED
Foundation Drainage Features		NA
Toe Drains		NA
Instrumentation System		NA

PERIODIC INSPECTION CHECK LIST

PROJECT [illegible] DAM DATE 12/6/78

PROJEC FEATURE INTAKE STRUCTURE BY CG, GC, TK

AREA EVALUATED	CONDITION
[illegible] INTAKE CHANNEL & INTAKE STRUCTURE	
a) Approach Channel	RESERVOIR BOTTOM HEAVILY SILTED - PER M.S.
Slope Conditions	NOT OBSERVED
Bottom Conditions	NOT OBSERVED
Rock Slides or Falls	NA
Log Boom	NONE
Debris	NONE OBSERVED BUT IS A CONCERN
Condition of Concrete Lining	NA
Drains or Weep Holes	NA
b) Intake Structure	
Condition of Concrete	GOOD
Stop Logs and Slots	NA
	LEFT GATE CRACKED @ MECHANISM & INOPERABLE

PERIODIC INSPECTION CHECK LIST

PROJECT [illegible] DAM DATE 12/6/78

PROJECT FEATURE [illegible] LEVEL OUTLET BY CG, GC, TK

AREA EVALUATED	CONDITION
[illegible] CREST AND OUTLET CHANNEL	
[illegible] Condition of Concrete	GOOD
[illegible] Staining	NA
[illegible]	NONE DUE TO OUTLET FLOW
[illegible] Vegetation	NONE
[illegible] Misalignment	NONE
[illegible] Differential Settlement	NONE
[illegible] Joints	NA
[illegible]	NA
[illegible] Trees Overhanging [illegible]	STEEP WOODED SLOPE TO LEFT 1 TREE IN D/S CHANNEL
[illegible] Discharge Channel	STONE WALL PARTIALLY COLLAPSED ABOUT 70' D/S OF DAM SILTED HEAVILY BY LOW LEVEL OUTLET

PERIODIC INSPECTION CHECK LIST

PROJECT KENNEY ALLAM DATE 12/6/78

PROJECT FEATURE SI[illegible]WAY & CHANNELS BY CG, GC, IK

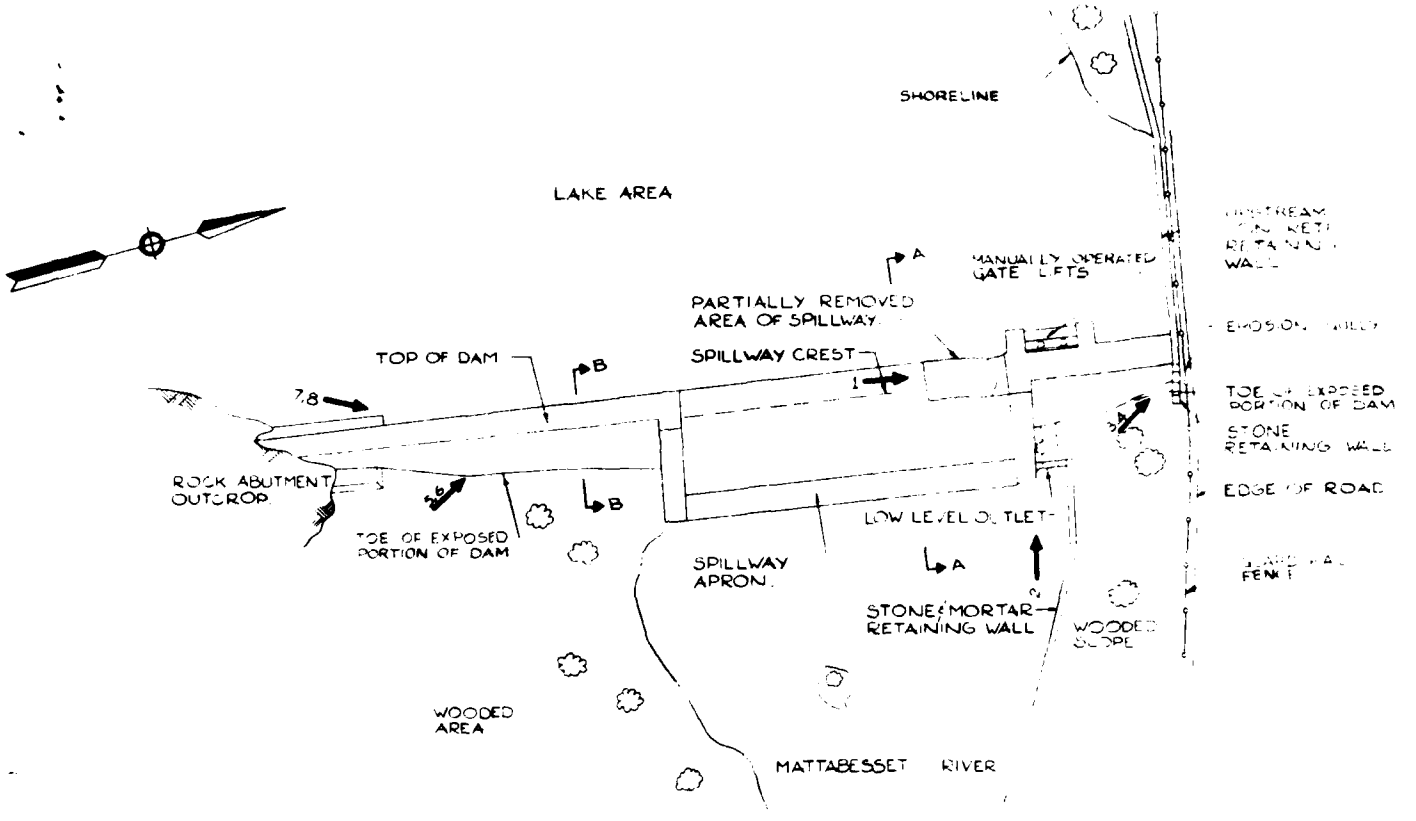
AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a) Approach Channel	
General Condition	GOOD
Loose Rock Overhanging Channel	NONE
Trees Overhanging Channel	NONE
Floor of Approach Channel	SILTED (PER U.S.)
b) Weir and Training Wall	
General Condition of Concrete	HEAVILY DETERIORATED
Rust or Staining	NONE
Spalling	SOME - MOST DAMAGE DUE TO ATTEMPTED REMOVAL
Any Visible Reinforcing	NONE
Any Seepage of Efflorescence	SOME - NOT A PRIME CONCERN
Drain Holes	NA
c) Discharge Channel	
General Condition	FAIR
Loose Rock Overhanging Channel	NONE
Trees Overhanging Channel	NONE OF CONCERN
Floor of Channel	SILTED NEAR DAM - THEN SAND & GRAVEL
Other Obstructions	SMALL TREE IN CENTER OF CHANNEL EROSION OF RIGHT CHANNEL BANK @ TOE OF DAM

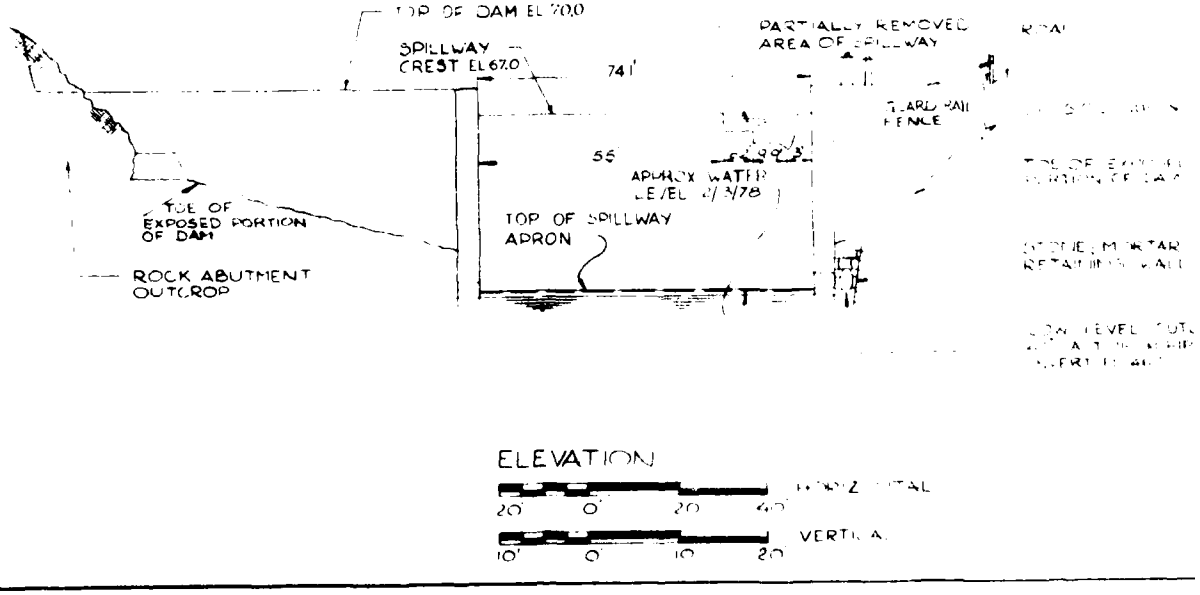
APPENDIX

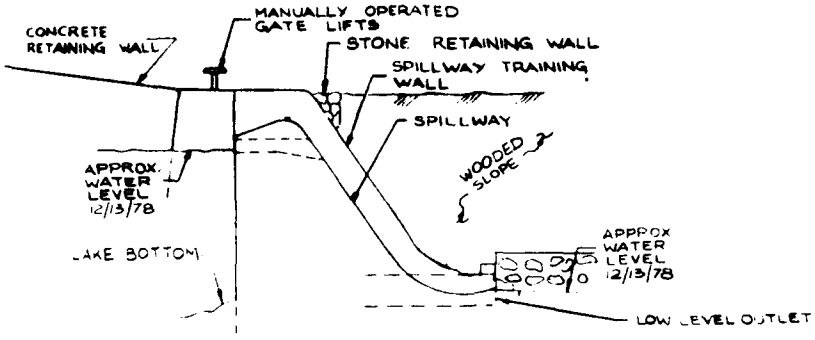
SECTION B: EXISTING DATA

APPENDIX

SECTION B: EXISTING DATA
KENSINGTON DAM

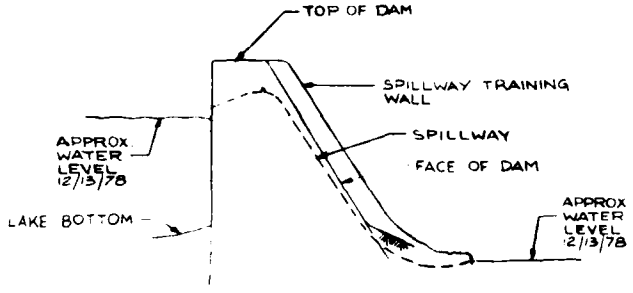

SHORELINE
LAKE AREA
A
MANUALLY OPERATED GATE LIFTS
PARTIALLY REMOVED AREA OF SPILLWAY
TOP OF DAM
B
SPILLWAY CREST
1
7.8
ROCK ABUTMENT OUTCROP
5
5.6
TOE OF EXPOSED PORTION OF DAM
B
LOW LEVEL OUTLET
SPILLWAY APRON
A
STONE MORTAR RETAINING WALL
WOODED SLOPE
WOODED AREA
MATTABESSET RIVER
EDGE OF ROAD
PLAN
20 0 20


TOP OF DAM EL 70.0
SPILLWAY CREST EL 67.0
74'
PARTIALLY REMOVED AREA OF SPILLWAY
55
APPROX WATER LEVEL 9/3/78
TOP OF SPILLWAY APRON
TOE OF EXPOSED PORTION OF DAM
ROCK ABUTMENT OUTCROP
ROAD
ELEVATION
20 0 20 40
10' 0 10 20



SECTION A-A

10' 0' 10' 20'



SECTION B-B

10' 0' 10' 20'

NOTES

THIS PLAN WAS COMPILED FROM ROUGH FIELD SURVEY ONLY.
NO EXISTING PLANS WERE AVAILABLE
NOT ALL TOPOGRAPHIC AND/OR STRUCTURAL FEATURES ARE IDENTIFIED

2 AS NO ELEVATIONS WERE AVAILABLE FOR THE DAM THE WATER SURFACE ELEVATION SHOWN ON THE USGS NEW BRITAIN QUADRANGLE WAS ASSUMED TO BE THE ELEVATION OF THE SPILLWAY CREST AS ORIGINALLY CONSTRUCTED ALL OTHER ELEVATIONS SHOWN ARE REFERENCED TO THE ASSUMED SPILLWAY CREST ELEVATION.

3 ◀—1 PHOTO NUMBER AND DIRECTION

CAHN ENGINEERS INC WALLINGFORD, CONNECTICUT ENGINEER	U S ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS

NATIONAL PROGRAM OF INSPECTION OF NON-FED DAMS

KENSINGTON DAM

MATTABESSET RIVER — BERLIN, CONNECTICUT

DRAWN BY	CHECKED BY	APPROVED BY	SCALE AS NOTED	
H N	[illegible]	[illegible]	DATE FEB 1979	PAGE B-1

(2)

SUMMARY OF DATA AND CORRESPONDENCE

DATE	TO	FROM	SUBJECT	PAGE
April 9, 1964	Files	Water Resources Comm. Supervision of Dams	Inventory Data	-3
June 16, 1977	Victor F. Galgowski Supt. of Dam Maintenance Water Resources Unit	Charles J. Pelletier Consultant, Environmental Protection	Kensington Dam Inspection Report	B-4

No. B-2

Inventoried By CWS

Date 1 APRIL 1964

WATER RESOURCES COMMISSION
SUPERVISION OF DAMS
INVENTORY DATA LONG 72-46.2 3
LAT. 41-37.9 CT-25

Name of Dam or Pond KENSINGTON DAM

Code No. C 28.5 M 12.6

Nearest Street Location MAIN STREET

Town BERLIN

U.S.G.S. Quad. NEW BRITAIN

Name of Stream MATTABESSET RIVER

N.Y. N. H. & H. RAILROAD ?

Address NEW HAVEN 6

Pond Used For RECREATION

Dimensions of Pond: Width 500 FEET Length 1200 FEET Area 15 ACRE.

Total Length of Dam 100 FEET Length of Spillway 5 FEET

Location of Spillway WEST END OF DAM

Height of Pond Above Stream Bed 30 FEET

Height of Embankment Above Spillway 5 FEET

Type of Spillway Construction CONCRETE

Type of Dike Construction CONCRETE

190! Downstream Conditions TOWN OF BERLIN

Summary of File Data H W BUCK INSPECTED DAM AND LETTER DATED 9-20-55 STATES " IN MY OPINION THIS STRUCTURE IS NOT UNSAFE AT THE PRESENT TIME."

Remarks

SUGGESTION COMMITTEE SAY: Improve Your Own Condition; Earn Cash and Recognition: Send in a Suggestion!

Interdepartment Message

SAVE TIME. *Handwritten messages are acceptable. Use carbon if you really need a copy. If typewritten, ignore faint lines*

	NAME	TITLE	DATE
TO	Victor F. Galgowski	Supt. of Dam Maintenance	16 Juen 1977
	AGENCY	ADDRESS	
	Water Resources Unit		
	NAME	TITLE	TELEPHONE
FROM	Charles J. Pelletier	Consultant	
	AGENCY	ADDRESS	
	Environmental Protection		

Kensington Dam, Berlin 3

This dam was inspected on June 14, 1977. The condition of the structure is about the same as that described in other recent inspection reports.

The dam is entirely concrete and is founded against basalt at both abutments. It is probable that the foundation is rock, possibly a sand stone.

The concrete appears to have been placed in 1.5 foot lifts. A major part of the deterioration in the concrete has occurred along the horizontal joints between lifts. At the north end of the spillway, part of the three top lifts are missing. This has lowered the water surface from 3' to 6' below the top of dam. This condition is illustrated in the 1964 photo in your file.

There is some seepage through these joints in that part of the dam south from the spillway.

There is also spalling on concrete on the training walls and on large areas on the lower portion of the spillway.

The concrete exposed in the joints and under spalled areas appears to be sound.

This dam probably can be repaired by removal of deteriorated concrete and restoration of the surface.

If repairs are not undertaken soon, seepage through the joints and frost action and ice pressure will gradually reduce the structure to an unsafe condition.

The dam does not appear to be in imminent danger of collapse, however, the actual condition of concrete in the interior of the dam is not known. We do not know whether there is any reinforcement in the concrete. There are two transverse cracks of unknown depth.

It appears appropriate to undertake an in depth investigation of the condition of this structure at this time so as to obtain repair or removal of this dam before it does become an immediate danger.

C. Pelletier
Water Resources Unit

CJP:ljk

B-4

APPENDIX

SECTION C: DETAIL PHOTOGRAPHS

PHOTO NO.1 - Spillway cutaway,gate valves, and upstream concrete retaining wall.

PHOTO NO.2 - Downstream view of left section of dam, spillway cutaway, and low level outlet.

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	NATIONAL PROGRAM OF	Kensington Dam Mattabesset River Berlin, Connecticut
CAHN ENGINEERS INC. WALLINGFORD, CONN. ARCHITECT — ENGINEER	INSPECTION OF NON-FED. DAMS	CE # 27 595 DATE Feb 1979 PAGE C-1

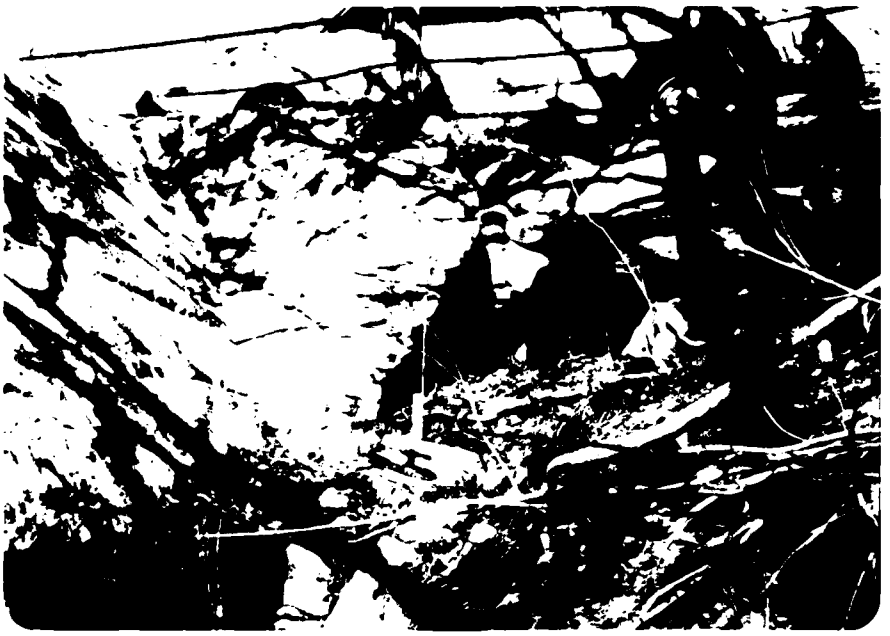


PHOTO NO.3 - Storm runoff channel from road and contact seep at extreme left end of dam.

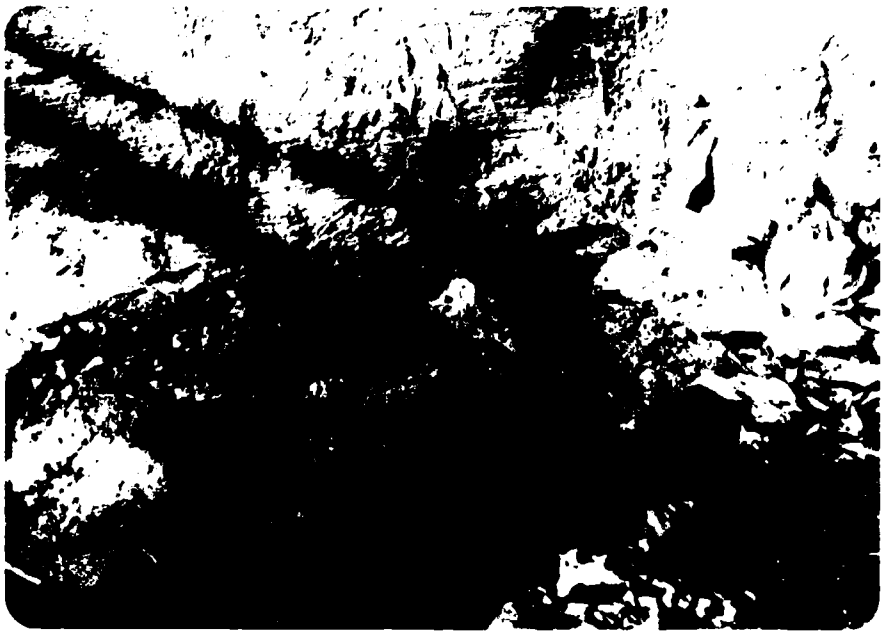


PHOTO NO.4 - Close-up of above contact seep.

US ARMY ENGINEER DIV. NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	NATIONAL PROGRAM OF	Kensington Dam Mattabesset River Berlin, Connecticut CE # [illegible] DATE Feb 1972 PAGE [illegible]
CAHN ENGINEERS INC. WALLINGFORD, CONN. ARCHITECT—— ENGINEER	INSPECTION OF NON-FED. DAMS	

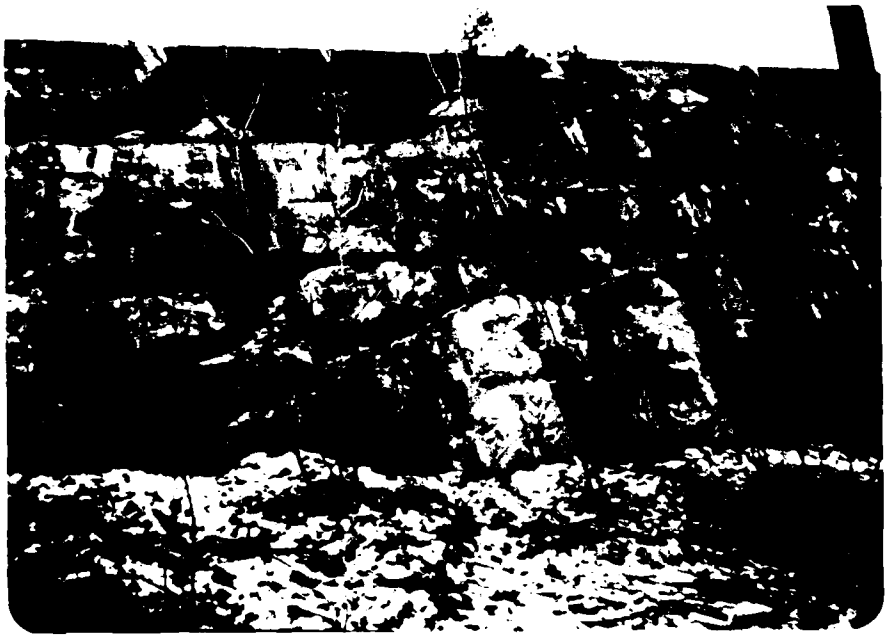


PHOTO NO.5 - Downstream face of right section of dam with extensive horizontal cracking and seepage.

PHOTO NO.6 - Close-up of above cracking and seepage.

US ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS	NATIONAL PROGRAM OF	Kensington Dam Mattabesset River Berlin, Connecticut CE # 27 595
CAHN ENGINEERS INC. WALLINGFORD, CONN ARCHITECT — ENGINEER	INSPECTION OF NON-FED. DAMS	DATE Feb 1979 PAGE C-3

PHOTO NO.7 - Upstream face of right section of dam with horizontal cracking.

PHOTO NO.8 - Close-up of above cracking.

US ARMY ENGINEER DIV NEW ENGLAND CORPS OF ENGINEERS WALTHAM, MASS.	NATIONAL PROGRAM OF	Kensington Dam Mattabesset River Berlin, Connecticut CE # 27 595
CAHN ENGINEERS INC. WALLINGFORD, CONN. ARCHITECT — ENGINEER	INSPECTION OF NON-FED. DAMS	DATE Feb 1979 PAGE C-4

APPENDIX

SECTION . HYDRAULIC/HYDROLOGIC COMPUTATIONS

PRELIMINARY GUIDANCE

FOR ESTIMATING

MAXIMUM PROBABLE DISCHARGE

IN

PHASE I DAM SAFETY

INVESTIGATIONS

New England Division
Corps of Engineers

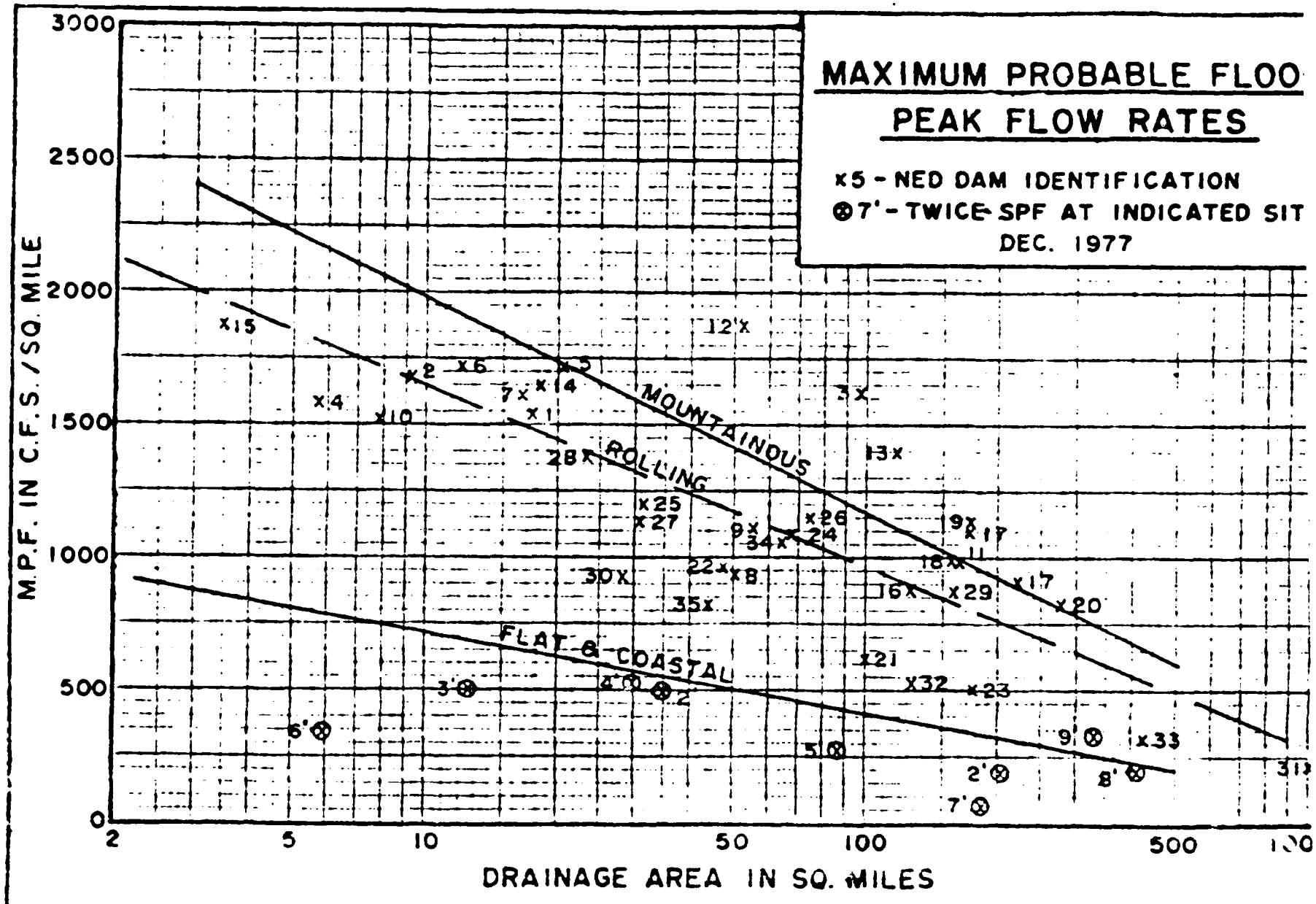
March 1978

MAXIMUM PROBABLE FLOOD INFLOWS
NED RESERVOIRS

Project	Q (cfs)	D.A. (sq. mi.)	MPF cfs/sq. mi.
1. Hall Meadow Brook	26,600	17.2	1,546
2. East Branch	15,500	9.25	1,675
3. Thomaston	158,000	97.2	1,625
4. Northfield Brook	9,000	5.7	1,580
5. Black Rock	35,000	20.4	1,715
6. Hancock Brook	20,700	12.0	1,725
7. Hop Brook	26,400	16.4	1,610
8. Tully	47,000	50.0	940
9. Barre Falls	61,000	55.0	1,109
10. Conant Brook	11,900	7.8	1,525
11. Knightville	160,000	162.0	987
12. Littleville	98,000	52.3	1,870
13. Colebrook River	165,000	118.0	1,400
14. Mad River	30,000	18.2	1,650
15. Sucker Brook	6,500	3.43	1,895
16. Union Village	110,000	126.0	873
17. North Hartland	199,000	220.0	904
18. North Springfield	157,000	158.0	994
19. Ball Mountain	190,000	172.0	1,105
20. Townshend	228,000	106.0(278 total)	820
21. Surry Mountain	63,000	100.0	630
22. Otter Brook	45,000	47.0	957
23. Birch Hill	88,500	175.0	505
24. East Brimfield	73,900	67.5	1,095
25. Westville	38,400	99.5(32 net)	1,200
26. West Thompson	85,000	173.5(74 net)	1,150
27. Hodges Village	35,600	31.1	1,145
28. Buffumville	36,500	26.5	1,377
29. Mansfield Hollow	125,000	159.0	786
30. West Hill	26,000	28.0	928
31. Franklin Falls	210,000	1000.0	210
32. Blackwater	66,500	128.0	520
33. Hopkinton	135,000	426.0	316
34. Everett	68,000	64.0	1,062
35. MacDowell	36,300	44.0	825

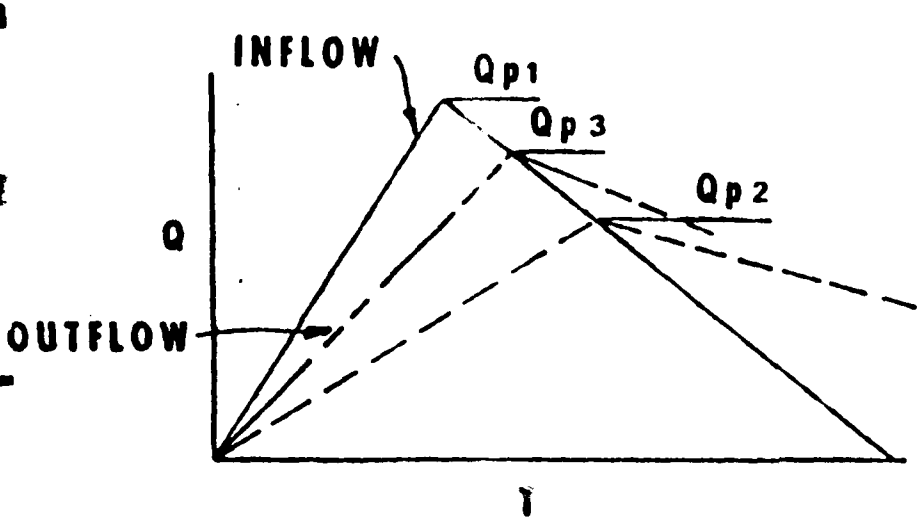
MAXIMUM PROBABLE FLOWS BASED ON TWICE THE STANDARD PROJECT FLOOD (Flat and Coastal Areas)

River	SPF (cfs)	D.A. (sq. mi.)	MPF (cfs/sq. mi.)
1. Pawtuxet River	19,000	200	190
2. Mill River (R.I.)	8,500	34	500
3. Peters River (R.I.)	3,200	13	490
4. Kettle Brook	8,000	30	530
5. Sudbury River.	11,700	86	270
6. Indian Brook (Hopk.)	1,000	5.9	340
7. Charles River.	6,000	184	65
8. Blackstone River.	43,000	416	200
9. Quinebaug River	55,000	331	330


MAXIMUM PROBABLE FLOO
PEAK FLOW RATES
x5 - NED DAM IDENTIFICATION
⊗7' - TWICE SPF AT INDICATED SIT
DEC. 1977
M.P.F. IN C.F.S./SQ. MILE
DRAINAGE AREA IN SQ. MILES
MOUNTAINOUS
ROLLING
FLAT & COASTAL
3000
2500
2000
1500
1000
500
0
2
5
10
50
100
500

D 4

ESTIMATING EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES



STEP 1: Determine Peak Inflow (Qp_1) from Guide Curves.

STEP 2: a. Determine Surcharge Height To Pass "Qp_1".

b. Determine Volume of Surcharge ($STOR_1$) In Inches of Runoff.

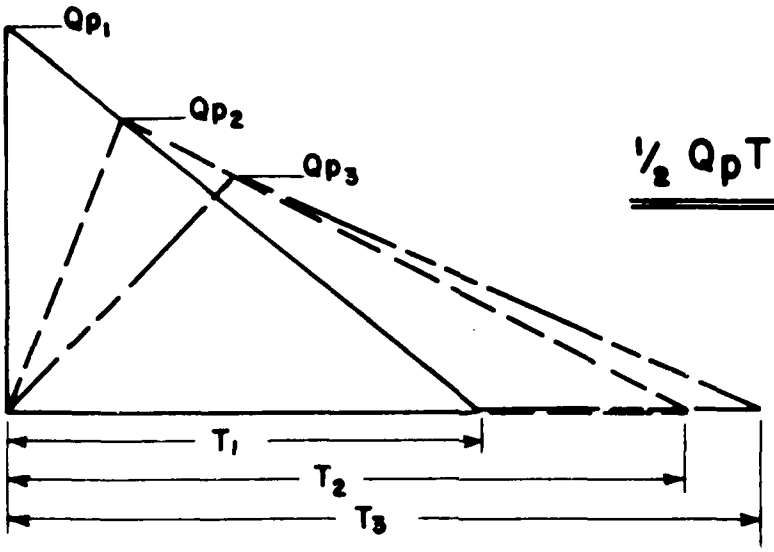
c. Maximum Probable Flood Runoff In New England equals Approx. 19", Therefore

$$Qp_2 = Qp_1 \times \left(1 - \frac{STOR_1}{19}\right)$$

STEP 3: a. Determine Surcharge Height and "$STOR_2$" To Pass "Qp_2"

b. Average "$STOR_1$" and "$STOR_2$" and Determine Average Surcharge and Resulting Peak Outflow "Qp_3".

"RULE OF THUMB" GUIDANCE FOR ESTIMATING DOWNSTREAM DAM FAILURE HYDROGRAPHS



$\frac{1}{2} Q_p T = 12 S$

STEP 1: DETERMINE OR ESTIMATE RESERVOIR STORAGE (S) IN AC-FT AT TIME OF FAILURE.

STEP 2: DETERMINE PEAK FAILURE OUTFLOW (Q_{p1}).

$$Qp_1 = \frac{8}{27} W_b \sqrt{g} Y_o^{3/2}$$

W_b = BREACH WIDTH - SUGGEST VALUE NOT GREATER THAN 40% OF DAM LENGTH ACROSS RIVER AT MID HEIGHT.

Y_o = TOTAL HEIGHT FROM RIVER BED TO POOL LEVEL AT FAILURE.

STEP 3: USING USGS TOPO OR OTHER DATA, DEVELOP REPRESENTATIVE STAGE-DISCHARGE RATING FOR SELECTED DOWNSTREAM RIVER REACH.

STEP 4: ESTIMATE REACH OUTFLOW (Q_{p2}) USING FOLLOWING ITERATION.

A. APPLY Q_{p1} TO STAGE RATING, DETERMINE STAGE AND ACCOPMANYING VOLUME (V_1) IN REACH IN AC-FT. (NOTE: IF V_1 EXCEEDS 1/2 OF S, SELECT SHORTER REACH.)

B. DETERMINE TRIAL Q_{p2}.

$$Qp_2(\text{TRIAL}) = Qp_1 \left(1 - \frac{V_1}{S}\right)$$

C. COMPUTE V_2 USING Q_{p2} (TRIAL).

D. AVERAGE V_1 AND V_2 AND COMPUTE Q_{p2}.

$$Qp_2 = Qp_1 \left(1 - \frac{V_{AVG}}{S}\right)$$

STEP 5: FOR SUCCEEDING REACHES REPEAT STEPS 3 AND 4.

APRIL 1978

Cahn Engineers Inc. Consulting Engineers

Project INSPECTION OF NON-FED. DAMS IN NEW ENGLAND Sheet 1 of 7
Computed By [illegible] Checked By [illegible] Date 1/5/79
Field Book Ref. [illegible] Other Refs CE#27-595-KA Revisions [illegible]

HYDROLOGIC/HYDRAULIC INSPECTION

KENSINGTON DAM, BERLIN, CT.

I) PERFORMANCE AT TEST FLOOD CONDITIONS:

1) MAXIMUM PROBABLE FLOOD:

a) WATERSHED CLASSIFIED AS "ROLLING TO MOUNTAINOUS"

b) WATERSHED AREA: D.A. = 9.9 sq mi (C.E. FROM U.S.G.S. 1:24000)

c) FROM NED/CE "PRELIMINARY GUIDANCE FOR ESTIMATING MAX PROBABLE FLOODS" - GUIDE CURVE FOR PMF-PEAK FLOWRATES:

PMF = 1800 CFS/SQ MI

d) PEAK INFLOW: PMF = 1800 × 9.9 = 17800 CFS

2) SPILLWAY DESIGN FLOOD (SDF)

a) CLASSIFICATION OF DAM ACCORDING TO NED-ACE RECOMMENDED GUIDELINES.

i) SIZE*: STORAGE (MAX) = 1.9 ACFT < 1000 ACFT
HEIGHT = 25' ≥ 25 FT

*STORAGE (MAX) FROM U.S. INVENTORY OF DAMS.
HEIGHT: ESTIMATED FROM C.E. SURVEY OF DEC. 1978

KENSINGTON DAM

2, 1-cont'd) CLASSIFICATION

(c) HAZARD POTENTIAL: THE DAM IS LOCATED U/S OF URBAN AREA IN BERLIN. 3 HOUSES, 1 STORAGE BLDG, ROAD "R" WITHIN 100 YRS D/S OF DAM.

(d) CLASSIFICATION:

SIZE: SMALL

HAZARD: HIGH

b) SDF = PMF = 17,800 CFS ½ PMF = 8900 CFS

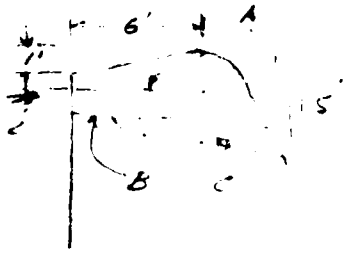
3) SURCHARGE AT PEAK INFLOWS:

a) PEAK INFLOW Q_{P_1} = 17800 CFS Q'_{P_1} = ½ PMF 8900 CFS

b) SPILLWAY (OUTFLOW) RATING CURVE

i) SPILLWAY

ORIGINALLY THE SPILLWAY WAS A BROAD CRESTED COMPOUND WEIR OF TRAPEZOIDAL CROSS SECTION WITH INCLINED FACES THE U/S FACE ON (1) 6" TO 1' SLOPE AND D/S FACE ON (2) 1" TO 1.5' SLOPE AND CREST LENGTH OF 74'. LATER, THE SPILLWAY WAS NOTCHED (JACKHAMMERED) TO THE SHOWN U/S SECTION AS DETERMINED BY CAHN ENGRS. SURVEY DATED DEC. 1978 (SEE NEXT PAGE). DAMAGED PORTION ALONG LINE "C" DO NOT GO TO THE U/S FACE AND THEREFORE ARE NOT CONSIDERED CONSEQUENTIAL FOR THE RATING CURVE.



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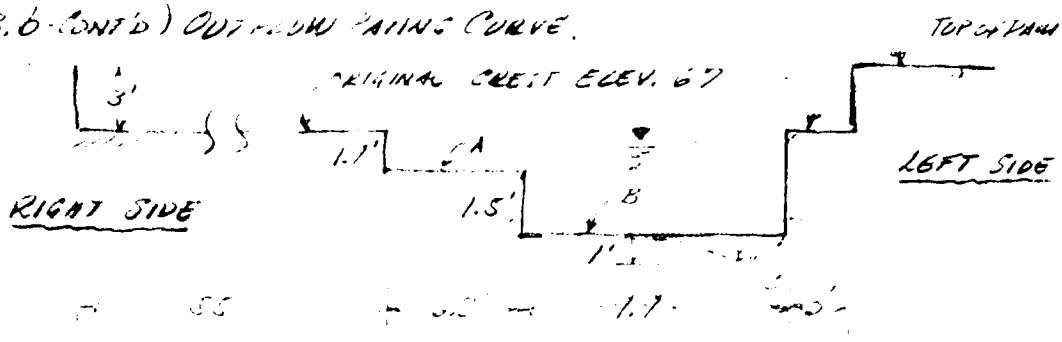
Project NON FEDERAL DAMS - SPECIFIC | Sheet 3 of 1
Computed By [illegible] | Checked By [illegible] | Date 11.21
Field Book Ref ____ | Other Refs CE#27-545-KA | Revisions ____

KENSINGTON DAM

3.b (CONT'D) OUTFLOW RATING CURVE.



DISCHARGE COEFFICIENTS. ASSUME:

a) ORIGINAL SPILLWAY C=3.1
b) NOTCHED SPILLWAY C=2.7

1. USING THE CREST ELEVATION AS DATUM, THE SPILLWAY DISCHARGE IS APPROXIMATED BY:

$$Q_s = 190 H^{3/2} + 17(H+1.4)^{3/2} + 27(H+3.4)^{3/2}$$

(2) EXTENSION OF RATING CURVE FOR SURCHARGE HEADS ABOVE TOP OF DAM

THE DAM IS A CONCRETE GRAVITY TYPE DAM 131' LONG (EXCL. SPWY.) W/ TOP WIDTH OF 15.5'. THE RIGHT ABUTMENT OF THE DAM IS SHOWN ROCK WITH (±) A VERTICAL FACE (±) 7' HIGH; THE LEFT ABUTMENT IS A CONCRETE RETAINING WALL ALONG THE EDGE OF THE ROAD THAT RUNS PERPENDICULAR TO THE AXIS OF THE DAM. THE TOP OF THE WALL RISES GRADUALLY APPROX. 5' IN A DISTANCE OF (±) 71' AND WILL ALLOW SOME OVERFLOW AT W.L. ABOVE THE TOP OF DAM (ELEV. 70).

ASSUME C=2.7 FOR OVERFLOW ABOVE BOTH DAM & LEFT ABUTMENT.

D-4

KENSINGTON DAM

3,0-Cont'd) OUTFLOW RATING CURVE

FURTHER FOR THE LEFT ABUTMENT ASSUME AN EQUIVACENT LENGTH (L'):

$$L' = \frac{2}{3}\left(\frac{71}{5}\right)(H-3)$$

THEREFORE, THE TOTAL OUTFLOW RATING CURVE CAN BE APPROXIMATED BY:

$$Q = Q_S + .250\,(H-3)^{3/2} + 26\,(H-3)^{5/2}$$

WHERE Q_S IS THE DISCHARGE OVER THE SPILLWAY (SEE 3,b,c)

THE OUTFLOW RATING CURVE IS PLOTTED ON NEXT PAGE (p.5)

c) SPILLWAY CAPACITY TO TOP OF DAM:

$H=3'$ $\therefore$ $Q = 1560^{CFS}$ (8.8% OF Q_{P_1}; 17.5% OF $Q_{P_1'}$)

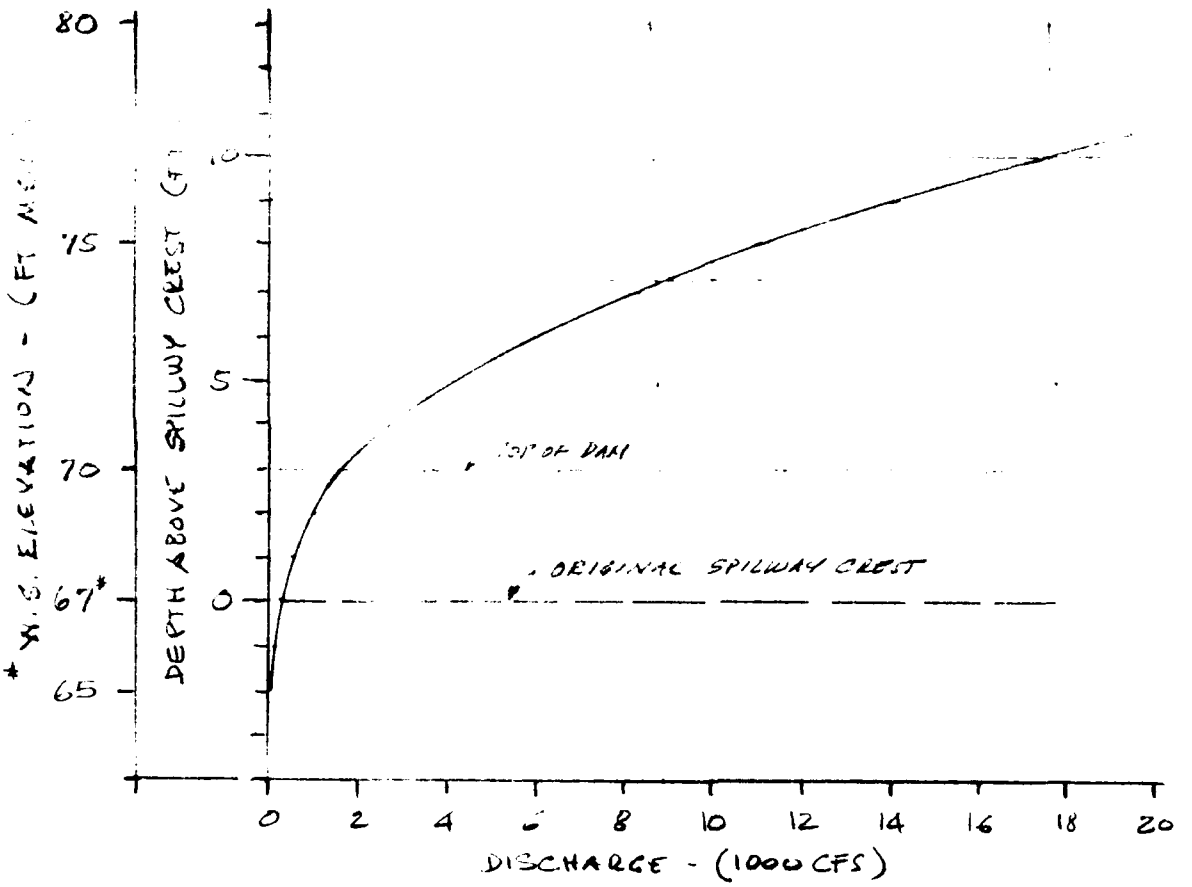
d) SURCHARGE HEIGHT TO PASS Q_{P_1}:

@ Q_{P_1} = PMF = 17,800 CFS $H_1 = 10.1'$

@ $Q_{P_1'}$ = ½ PMF = 8900 CFS $H_1' = 7.2'$

KENSINGTON DAM

3-CN'd) OUTFLOW RATING CURVE



$$Q = 180H^{3/2} + 11(H+1.1)^{3/2} + 31(H+3.4)^{3/2} + 350(H-3)^{3/2} + 26(H-3)^{3/2}$$

*U.S.G.S. NEW BRITAIN QUADRANGLE MAP W.C. ELEV 57' MSL ASSUMED TO BE (+) SPILLWAY CREST MSL ELEV.;

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Project NON FEDERAL DAMS INSPECTION — Sheet 6 of 1
Computed By HLL — Checked By CAC — Date 1/10/79
Field Book Ref — Other Refs CE#77-595-KA — Revisions —

KENSINGTON DAM

A) EFFECT OF SURCHARGE STORAGE ON MAXIMUM PROBABLE DISCHARGES (OUTFLOW)

a) RESERVOIR (LAKE) AREA @ FLOW LINE: *$A_0 = 15^{AC.}$

* FROM CONN. D.E.P. - WATER & RELATED RESOURCES, DATA SHEET: $A = 15^{AC}$
* E. MEASURE ON U.S.G.S. NEW BRITAIN, CT. QUADRANGLE SHEET, SCALE 1:24000, $A = 11.2^{AC}$

∴ ASSUME A.E. LAKE AREA WITHIN EXPECTED SURCHGE, $A = 15^{AC}$

b) ASSUME NORMAL POOL LEVEL AT SPILLWAY CREST (ELEV. 67')

c) WATERSHED AREA: $DA = 9.7^{Sq.mi}$ (SEE p. 1)

d) DISCHARGE Q_{P_2} AT VARIOUS SURCHARGE ELEVATIONS

$H = 13'$ $V = 13 \times 15 = 195^{AC\text{-}FT}$ ∴ $S = \frac{195}{1.9 \times 53.3} = 2.07"$

$H = 5'$ $V = 5 \times 15 = 75^{ACFT}$ ∴ $S = 2.14"$

∴ FROM APPROXIMATE STORAGE ROUTING NED-ACE GUIDELINES (19" MAX. PROB. RO. IN NEW ENGLAND):

$Q_{P_2} = Q_{P_1}\left(1 - \frac{S}{19}\right)$ AND FOR ½PMF: $Q'_{P_2} = Q'_{P_1}\left(1 - \frac{S}{9.5}\right)$

∴ FOR

$H = 13'$ $Q_{P_2} = 17500^{CFS}$ $Q'_{P_2} = 8550^{CFS}$

$H = 5'$ $Q_{P_2} = 17700^{CFS}$ $Q'_{P_2} = 8770^{CFS}$

KENSINGTON DAM

4. CHK'G) EFFECT OF SURCHARGE STORAGE ON MAX. INFLOW DISCHARGE.

c). PEAK OUTFLOW (Q_{P_3})

USING NED-ACE GUIDELINES "SURCHARGE STORAGE ROUTING ALTERNATE" METHOD (SEE p. 5)

$Q_{P_3} = 17,600^{CFS}$ $H_3 = 10'$ FOR $Q_{P_1} = PMF$

$Q'_{P_3} = 8,800^{CFS}$ $H'_3 = 7.2'$ FOR $Q'_{P_1} = \frac{1}{2} PMF$

d) SPILLWAY CAPACITY RATIO TO OUTFLOW:

SPILLWAY CAPACITY TO TOP OF DAM: $Q_{12} = 1560^{CFS}$ (see p. 4)

∴ SPILWY CAP. IS (±) 8.9% THE OUTFLOW @ PMF AND (±) 18% THE OUTFLOW @ ½ PMF.

5) SUMMARY:

a) PEAK INFLOW $Q'_{P_1} = \frac{1}{2} PMF = 8900^{CFS}$ TO $Q_{P_1} = PMF = 17800^{CFS}$
b) PEAK OUTFLOW $Q'_{P_3} = 8800^{CFS}$ TO $Q_{P_3} = 17600^{CFS}$

c) SPILLWAY MAX. CAPACITY: $Q = 1560^{CFS}$ OR 18% OF Q'_{P_3} AND 8.1% Q_{P_3}

THEREFORE, AT SDF = ½ PMF THE DAM WILL BE OVERTOPPED (±) 4.2' (W.S. ELEV. (±) 74.2' MSL) OR AN AVE. SURCHARGE ABOVE THE SPILLWAY CREST OF 7.2'

DOWNSTREAM FAILURE HAZARD

PEAK FLOOD AT IMMEDIATE IMPACT AREA.

BREACH W.

MID-HEIGHT ELEV. 57.5' MSL (≈ 77.1' C.E. SURVEY)

DAM HEIGHT LENGTH $L = 157'$

BREACH WIDTH (SEE NED-ACE DOWNSTREAM DAM FAILURE GUIDELINES)

$W = 2.4 < 157 = 62.5$ ∴ ASSUME $W_b = \underline{60'}$

PEAK FAILURE OUTFLOW (Q_{p_1})

A DAM. EXCHANGE TO TOP OF DAM, THEREFORE, HEIGHT AT TIME OF FAILURE. $Y_0 = 25'$

SPILLWAY DISCHARGE. $Q_s = 1560$ CFS.

BREACH OUTFLOW (Q_b):

$$Q_b = \frac{8}{27} W_b \sqrt{g}\, Y_0^{3/2} = 12630 \text{ CFS}$$

PEAK FAILURE OUTFLOW (Q_{p_1})

$$Q_{p_1} = Q_s + Q_b = \underline{14200} \text{ CFS}$$

KENSINGTON DAM

I - Cont'd) DOWNSTREAM FAILURE HAZARD

c) FLOOD WAVE HEIGHT IMMEDIATELY D/S OF DAM:

$y \cong .34\, y_o \cong 11'$

SUMMARY:

a) PEAK FAILURE OUTFLOW $\cong 14200$ CFS
b) STAGE AT IMMEDIATE IMPACT AREA $\cong 11'$

APPENDIX

SECTION E: INVENTORY OF DAMS IN UNITED STATES

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST	STATE	COUNTY	CONGR DIST	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY	MO	YR
CT	25[illegible]	NED	CT	003	01				KENSINGTON DAM	4137.9	7240.2	04	FEB	79

POPULAR NAME	NAME OF IMPOUNDMENT

REGION BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY–TOWN–VILLAGE	DIST FROM DAM (MI.)	POPULATION
01 08	MATTABESSET RIVER	KENSINGTON	1	6000

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE–FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE–FT.)	LIST	ORN	FED R	PRV/FED	SCS A	VER/DATE
PGCT	1901	R		25	198	180	NED	N	N	N	N	04FEB79

REMARKS

2[illegible] LOW POINT OF FOUNDATION NOT KNOWN

DAMS HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	205	U	74	1500												

OWNER	ENGINEERING BY	CONSTRUCTION BY
TOWN OF BERLIN		

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	NONE

INSPECTION BY	INSPECTION DATE DAY	MO	YR	AUTHORITY FOR INSPECTION
CAMP ENGINEERS INC	06	DEC	78	PUBLIC LAW 92-367 8AUG1972

REMARKS

4748 NO CONSTRUCTION DATA ORIGINALLY BUILT FOR OR BY NY NH & H RAILROAD

END

FILMED

8-84

DTIC